FORCED AIR OVENS

MICROPROCESSOR CONTROLLED

MODELS:
TFO-1, TFO-3, TFO-5, TFO-10, TFO-28

INSTALLATION AND OPERATIONAL MANUAL
REV 01.07

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These are general purpose, forced air ovens for professional, industrial or educational use where the preparation or testing of materials is done at approximately atmospheric pressure and no flammable, volatile or combustible materials are being heated. These units are not intended for hazardous or household locations or use.

Section 1

RECEIVING AND INSPECTION

Your satisfaction and safety require a complete understanding of this unit. Read the instructions thoroughly and be sure all operators are given adequate training before attempting to put the unit in service. NOTE: This equipment must be used only for its intended application; any alterations or modifications will void your warranty.

1.1 **Inspection:** The carrier, when accepting shipment, also accepts responsibility for safe delivery and is liable for loss or damage. On delivery, inspect for visible exterior damage, note and describe on the freight bill any damage found, and enter your claim on the form supplied by the carrier.

1.2 Inspect for concealed loss or damage on the unit itself, both interior and exterior. If necessary, the carrier will arrange for official inspection to substantiate your claim.

1.3 **Return Shipment:** Save the shipping crate until you are sure all is well. If for any reason you must return the unit, first contact your customer service representative for authorization. Supply nameplate data, including model number and serial number.

1.4 **Accessories:** Verify that all of the equipment indicated on the packing slip is included with the unit. Carefully check all packaging before discarding.

Section 2

GRAPHIC SYMBOLS

Your oven may contain a variety of graphic symbols which should help in identifying the use and function of the available user adjustable components.

2.1 This symbol indicates that you should consult your manual for further description or discussion of a control or user item.

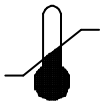
2.2 Indicates **"AC Power"**

2.3 Indicates **"Manual Control"**

2.4 Indicates **"Timer"**

2.5 °C Indicates **"Degrees Celsius"**

2.6 Indicates **"Temperature"**

2.7  Indicates **"Over Temperature Safety"**

2.8 Indicates **"Earth Ground"**

2.9 Indicates **"Potential Shock Hazard"** behind partition

2.10 Indicates **"Unit should be recycled"** (Not disposed of in land-fill)

Section 3
INSTALLATION

Local city, county or other ordinances may govern the use of this equipment. If you have any questions about local requirements, please contact the appropriate local agency. Installation may be performed by the end user. Under normal circumstances this unit is intended for use indoors, at room temperatures between 5° and 40°C, at no greater than 80% Relative Humidity (at 25°C) and with a supply voltage that does not vary by more than 10%.

3.1 Power Source: The electrical supply circuit to the oven must conform to all national and local electrical codes. Consult the serial data plate for the voltage, cycle wattage and ampere requirements before making connection. VOLTAGE SHOULD NOT VARY MORE THAN 10% FROM THE SERIAL PLATE RATING. This unit is intended for 50/60 Hz application. A separate circuit is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit.

3.2 Location: When selecting a site for the oven, consider all conditions which may affect performance, such as extreme heat from steam radiators, stoves, ovens autoclaves, etc. Avoid direct sun, fast-moving air currents, heating/cooling ducts, and high traffic areas. To ensure air circulation around the unit allow a minimum of 30 cm between the unit and any walls or partitions which might obstruct free airflow.

3.3 Lifting / Handling: These units are heavy and care should be taken to use appropriate lifting devices that are sufficiently rated for these loads. Units should only be lifted from their bottom surfaces. Doors, handles and knobs are not adequate for lifting or stabilization. The unit should be completely restrained from tipping during lifting or transport. All moving parts, such as shelves and trays should be removed and doors need to be positively locked in the closed position during transfer to prevent shifting and damage.

3.4 Leveling: The unit must sit level and solidly. Leveling feet are supplied and must be installed in the four holes in the bottom corners of the unit. With the unit standing upright, turn the leveling feet counterclockwise to raise level. If the unit must be moved, turn the leveling feet in all the way to prevent damage.

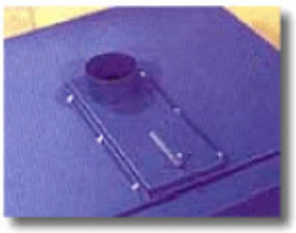
3.5 Cleaning: The oven interior was cleaned at the factory, but not sterilized. Remove all interior parts if assembled and clean with a disinfectant that is appropriate to your application. DO NOT USE chlorine-based bleaches or abrasives as this will damage the stainless steel interior. DO NOT USE spray cleaners that might leak through openings and cracks and get on electrical parts or that may contain solvents that will harm the coatings. A similar periodic cleaning is recommended.

WARNING: Never clean the unit with alcohol or flammable cleaners with the unit connected to the electrical supply. Always disconnect the unit form the electrical service when cleaning and assure all volatile or flammable cleaners are evaporated and dry before reattaching the unit to the power supply.

3.6 Burn In: It is recommended that the unit go through a “burning in” process prior to operation. This is to eliminate the smoking of protective coatings on the element. Read sections 4, 5 and 6 carefully to understand operating requirements. To burn in, turn the Over-Temperature Safety to maximum and set the digital display to 200°C. Run a minimum of one (1) hour until smoke dissipates.

Section 4
PRECAUTIONS

4.1 These units have been designed with vents on top of the chamber. In order to work effectively and safely, some precautions will need to be taken by the operator.



A. In most applications, the vent will need to be opened during drying or degassing for best results.

B. **THIS OVEN IS NOT DESIGNED TO HANDLE COMBUSTIBLE GASSES AND IS NOT AN EXPLOSION PROOF UNIT. Do not place explosive, combustible, or flammable materials into the chamber.**

C. Some of the outgassed by-products may be hazardous or unpleasant to operating personnel. If this is the case, the exhausts should be positively ventilated to the outside and dealt with according to local regulations.

4.2 Do not operate near noxious fumes.

4.3 Do not place sealed or filled containers in the oven chamber.

4.4 Do not cut or remove the ground prong from the power cord.

4.5 Be sure that the power supply is of the same voltage as specified.

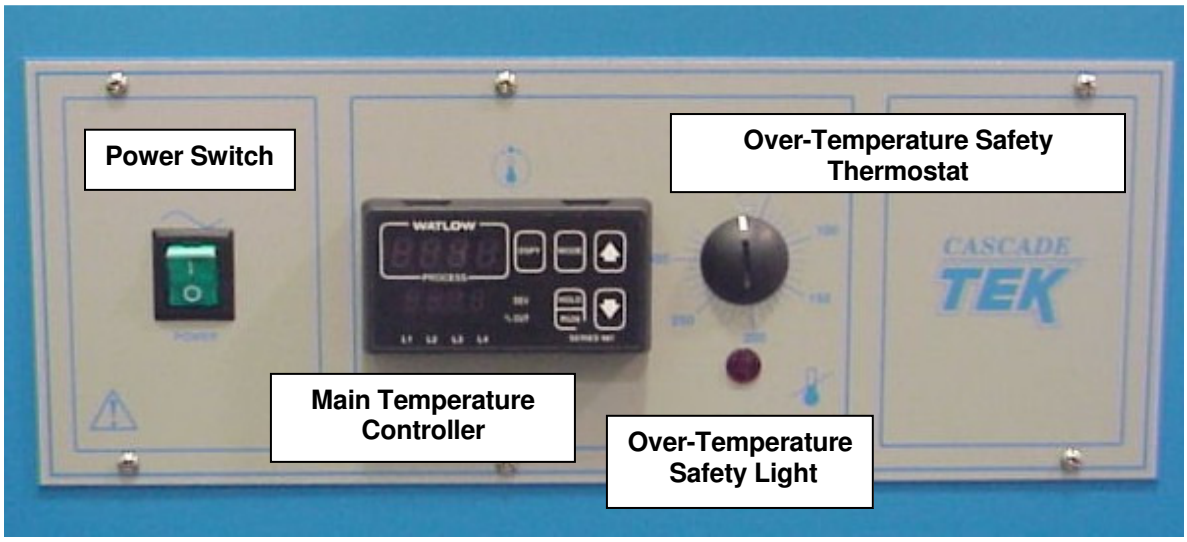
4.6 Disconnect the unit from the electrical source before proceeding to make any electrical repairs or replacements.

4.7 If a mercury thermometer is used and breakage should occur, all spilled mercury MUST be completely removed from the chamber before continuing operation.

4.8 This oven is NOT designed for use in Class I, II, or III locations as defined by the National Electrical Code.

4.9 This oven is not intended, nor can it be used, as a patient connected device.

Section 5
CONTROL PANEL OVERVIEW



5.1 Power Switch: The main power switch on the control panel (green lighted I/O) controls all power to the unit and must be in the I/ON position before any systems are operational. The switch will be lighted when in the I/ON position.

5.2 Main Temperature Control: This controller consists of the digital display and UP/DOWN arrow pads for inputting set point temperatures and calibration.

5.4 Over-Temperature Safety Thermostat: This control is marked with a graduated dial. It is independent of the Main Controller and guards against any failure which would allow the temperature to rise past the Main Controllers set point. This allows continued operation of the oven until the problem can be corrected or service can be arranged. It is not recommended that the unit be operated for extended periods of time using only the Over-Temperature Safety as the controller as temperature uniformity will suffer. See Section 6 on how to set the Over-Temp Safety Thermostat.

5.5 Over-Temperature Safety Light: This pilot lamp is directly below the Over-Temperature Safety Thermostat. The light will come on when the Safety Thermostat has been activated and taken control of the oven temperature. Under normal operating conditions this pilot lamp should never be on.

Section 6
OPERATION

6.1 Connection to Power Supply: Assure that the electrical power supply is properly configured and rated for the oven.

6.2 Flip the POWER switch to the ON position. The digital temperature display will indicate a temperature value. It should light up if properly connected to the power supply.

6.3 Set Main Temperature Controller: Please refer to the Watlow Controller Manual supplied with your oven for programming and more detailed information regarding the controller. Two important points of reference are the sections pertaining to KEY FUNCTIONS and SIMPLE SET POINT OPERATION.

6.4 Set Over-Temperature Safety Thermostat (OTP):

(A) The OTP should be initially set to its maximum position to allow the unit to stabilize.

(B) Once the oven is stabile at the desired set point, turn the OTP knob left (counterclockwise) until the OTP light turns ON.

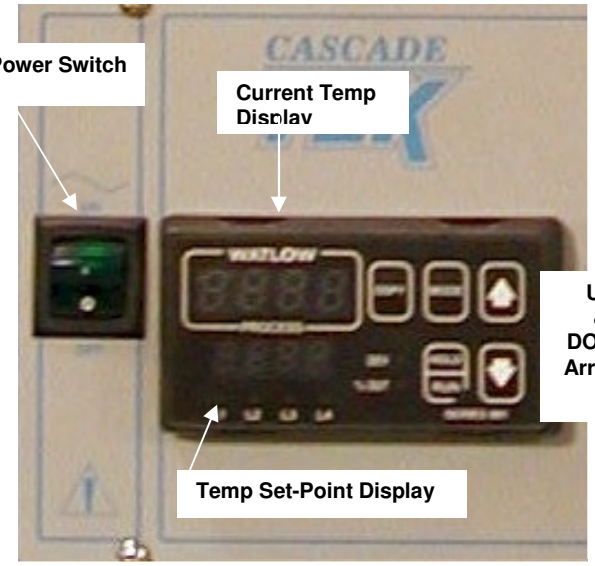
(C) Next, turn the OTP knob back to the right (clockwise) just until the OTP light turns OFF and continue turning the OTP knob to the right another hash mark. This sets the Safety Thermostat at a temperature approximately 10°C above the Main Temperature set point. Note that the OTP Safety is in series with the output from the control relay, and the OTP light will be blinking when the Main Temperature Controller is calling for heat.

(D) Please note the scale is for reference only and does not correlate to the temperature reading of the main controller.

6.5 Using Exhaust Vent(s): The slide damper vent(s) on the top of the oven control volume of ventilation. If you want moderate ventilation in the oven, open the vent at the top. Maximum flow thru the vent(s) will slightly increase heat up and recovery time.

6.6 Recommended Burn-In: The Refer to Section 3.5 and 3.6 for information on recommended cleaning and burn in process prior to operation.

6.7 Quick Start Operation Example



1. Turn on the power switch (located at the left of the instrument panel) It should glow with a green light if it is connected to the power correctly.

2. The "Process" window (upper window on your Watlow 981controller) will display the current chamber temperature.

3. The lower window of your controller will indicate the current temperature set point.

4. To increase the set point, press the UP arrow key until the desired set point is displayed in the lower controller window.

5. To decrease the set point, press the down arrow key until the desired set point is displayed in the lower controller window.

6. The oven will heat to your selected set point and remain there until changed. Note: The set point will not change even if the power is turned on and off.

7. Please refer to the enclosed Controller manual for complete instructions.

SIMPLIFIED 981 INSTRUCTIONS

THE 981 IS A MICROPROCESSOR BASED RAMP AND SOAK, PROGRAMMABLE TEMPERATURE CONTROLLER. IT IS CAPABLE OF BEING PROGRAMMED WITH UP TO FOUR PROFILES. A RAMP IS A CONTROLLED CHANGE IN TEMPERATURE OVER A SPECIFIED PERIOD OF TIME. A SOAK IS A HOLD AT PARTICULAR TEMPERATURE FOR A SPECIFIED PERIOD OF TIME WITH UP TO SIX STEPS EACH. PROFILES CAN BE LINKED FOR PROGRAMS NEEDING MORE STEPS UP TO A TOTAL OF 21 RAMPS OR SOAKS.

SINGLE TEMPERATURE OPERATION

NORMALLY, AN AVERAGE USER ONLY WANTS TO OPERATE THE OVEN AT ONE TEMPERATURE. WHEN THE OVEN IS TURNED ON THE CONTROLLER WILL SHOW THE TEMPERATURE WITHIN THE OVEN ON THE TOP DISPLAY. THE BOTTOM DISPLAY WILL SHOW THE SETPOINT. THE CONTROLLER WILL MAINTAIN THE TEMPERATURE WITHIN THE OVEN TO WHATEVER THE LOWER DISPLAY IS SET FOR. TO CHANGE THE SETPOINT PRESS THE UP OR DOWN KEYS UNTIL THE DESIRED TEMPERATURE IS DISPLAYED IN THE LOWER DISPLAY.

TIMED OPERATION

SOMETIMES A USER WILL WANT TO OPERATE THE OVEN AT A GIVEN TEMPERATURE FOR A SPECIFIED PERIOD OF TIME AND THEN COOL OFF. TO DO THIS, A SMALL PROGRAM MUST BE PUT INTO THE CONTROLLER.

BEFORE ATTEMPTING TO PROGRAM THE CONTROLLER IT IS HELPFUL TO LEARN A SMALL AMOUNT ABOUT HOW THE CONTROLLER IS PROGRAMMED.

THE CONTROLLER HAS THREE MAIN MENUS. (SEE THE USERS MANUAL FOR IN DEPTH INFORMATION). THESE ARE THE SETUP MENU, FACTORY MENUS, AND THE OPERATION MENU.

THE SETUP MAIN MENU HAS FOUR SUB MENUS, INPUT, OUTPUT, GLOBAL AND COM. THESE ARE ALL PREPROGRAMMED AT THE FACTORY AND SHOULD NEED NO ADJUSTMENT UNDER MOST CIRCUMSTANCES. THE FACTORY MENU SHOULD NEVER BE ACCESSED OR CHANGED BY ANYONE OTHER THAN AN AUTHORIZED FACTORY REPRESENTIVE.

THE OPERATION MENU HAS THREE SUB MENUS. SYSTEM, P.I.D. AND PROGRAM . THE SYSTEM AND THE P.I.D. MENUS ARE FACTORY PRESET AND SHOULD NOT NEED ANY ADJUSTMENT UNDER NORMAL CIRCUMSTANCES. THE THIRD SUB MENU UNDER THE OPERATION MENU IS PROGRAM AND THIS IS WHERE YOU PROGRAM YOUR RAMP AND SOAK PROFILES.

THE PROGRAM SUB MENU IS USED TO INPUT TIME AND TEMPERATURE STEPS INTO THE CONTROLLER. THE FIVE TYPES OF STEPS THAT CAN BE PROGRAMMED ARE SETPOINT, SOAK, JUMP LOOP AND END. A SETPOINT STEP INPUTS THE TEMPERATURE DESIRED AND THE TIME TAKEN TO GET TO THAT TEMPERATURE. A SOAK STEP ONLY INPUTS THE AMOUNT OF TIME THAT THE TEMPERATURE IN THE PREVIOUS STEP IS MAINTAINED. A JUMP LOOP TELLS THE CONTROLLER TO JUMP TO ANOTHER STEP. A LINK FILE JUMPS TO ANOTHER PROFILE AND END STEP ENDS THE PROGRAM.

IN PROGRAMMING, EACH STEP IS A SERIES OF COMMANDS. FOR A SETPOINT STEP THE COMMANDS ARE SP(SETPOINT), HOUR(HOURS), MIN(MINUETS), SEC(SECONDS), ENT3(EVENT THREE THE POWER EXHAUST OUTLET). THE SETPOINT IS THE TEMPERATURE THAT YOU WANT THE OVEN TO GO TO. THE HOURS, MINUTES AND SECONDS IS THE TIME YOU WANT THE OVEN TO TAKE TO REACH SETPOINT. IF YOU WANT THE OVEN TO REACH SETPOINT AS FAST AS POSSIBLE THEN SET THESE TIMES TO ZERO. THE EVENT THREE IS WHETHER THE POWER EXHAUST OUTLET IS TURNED ON OR OFF.

A SOAK STEP HAS FIVE COMMANDS. THERE ARE TREE COMMANDS FOR TIME; HOUR, MIN AND SEC. THESE WOULD BE SET FOR THE AMOUNT OF TIME THAT YOU WANT THE OVEN TO RUN AT THE OPERATING TEMPERATURE. THE FOURTH COMMAND IS ENT1 THE POWER EXHAUST OUTLET. THE FIFTH COMMAND IS WPR WHETHER OR NOT THE CONTROL SHOULD WAIT UNTIL A PARTICULAR PROCESS VALUE IS REACHED.

A JUMP LOOP STEP HAS ONLY THREE COMMANDS JF(JUMP FILE), JS(JUMP START) AND JC(JUMP COUNT)

THE LINK FILE STEP HAS ONLY ONE COMMAND LFIL FILE TO LINK TO AN END STEP HAS ONLY ONE COMMAND END.

AN EXAMPLE OF A SIMPLE PROGRAM WOULD BE ONE IN WHICH YOU WANT THE OVEN AT 90 TO 100 DEGREES, MAINTAIN 100 DEGREES FOR 5 1/2 HOURS AND THEN COOL DOWN TO ROOM TEMPERATURE. THIS WOULD BE FOUR STEP PROGRAM. THE FIRST STEP WOULD BE A SETPOINT STEP. THE SETPOINT WOULD BE 100 DEGREES. THE TIME WOULD BE PROGRAMMED AS ZERO SINCE YOU WANT THE OVEN TO GET 100 AS FAST AS POSSIBLE. THE SECOND STEP WOULD BE A SOAK STEP. THE SOAK TIME WOULD BE 5 HRS. AND 30 MIN. THE THIRD STEP WOULD BE A SETPOINT STEP WITH THE SETPOINT SET TO ZERO AND THE TIME SET TO ZERO. THE FINAL STEP WOULD BE AN END STEP.

Section 7
MAINTENANCE

7.1 Cleaning: Clean the oven interior and remove and clean shelves on a regular basis. Use a disinfectant that is suitable for your application. DO NOT USE chlorine-based bleaches or abrasives, as this will damage the stainless steel interior. DO NOT USE spray cleaners that might leak through openings and cracks and get on electrical parts or that may contain solvents that will harm the coatings. A similar periodic cleaning is recommended. Use care when cleaning the door gasket to prevent damage which could impair the positive door seal.

WARNING: Never clean the unit with alcohol or flammable cleaners with the unit connected to the electrical supply. **Always disconnect the unit form the electrical service when cleaning and assure all volatile or flammable cleaners are evaporated and dry before reattaching the unit to the power supply.**

7.2 Storage: To prepare the unit for storage, remove all shelves and shelf clips, dry the chamber completely and disconnect the power supply. Be certain that the door is positively locked in the closed position. See Section 3.3, Lifting/Handling, for proper transport procedures.

7.3 No maintenance is required on the electrical components. If the unit fails to operate as specified, please see the Troubleshooting guide, Section 8.0, before calling for service.

7.4 Preventative Maintenance Recommendations:

- Clean the oven interior and shelves whenever they get stained or dirty.
- Inspect the door gasket, making sure it is in good condition, and that the door seals snugly against its mullion.
- Level the oven, using its adjustable feet.
- If you suspect that air flow across the work space has decreased, have the blower wheel cleaned. It is possible for the blower to get dirty if the oven is used with dirty, lint-laden loads.
- Test the Overtemp Thermotstat (OTP). Run the oven at some usual temperature. Stabilize. Turn the OTP safety thermostat to a temperature lower than that on the main temperature controller. Make sure the OTP light comes on, and that oven temperature decreases.

Section 8
TROUBLESHOOTING

TEMPERATURE

Temperature too high

1/ Controller set too high-see section 6.3
2/ Controller failed on – call Customer Service.
3/ Wiring error – call Customer Service.

Display reads "HI" or "400"+

Probe is unplugged, is broken or wire to sensor is broken – trace wire from display to probe; move wire and watch display to see intermittent problems

Temperature too low

1/ OTP limit set too low – see section 6.4.
2/ Controller set too low – see section 6.3.
3/ Unit not recovered from door opening – wait for display to stop changing.
4/ Unit not recovered from power failure or being turned off – ovens will need several hours to warm up and stabilize.
5/ Element failure – compare current draw to data plate.
6/ Controller failure – call Customer Service.
7/ OTP limit failure – confirm with front panel lights that Safety Thermostat is operating correctly. See Section 7.4
8/ Wiring problem – check all functions and compare wiring to schematic in section 13.0 - especially around any areas recently worked on.
9/ Loose connection – check control panel for loose connections.

Display reads "LO"

1/ Bad probe or disconnected – call Customer Service.
2/ If ambient temperature is lower than range of unit – compare set points and ambient temperature to rated specifications in section 12.0.

Unit will not heat over a temperature that is below set point

1/ Confirm that fan is moving and that amperage and voltage match data plate – check for air movement in chamber.
2/ Confirm that set point is set high enough –turn Safety Thermostat all the way clockwise and see if OTP light comes on.
3/ Check connections to sensor.

Unit will not heat up at all

1/ Check amperage – amperage should be virtually at maximum rated (data plate) amperage.
2/ Do all controller functions work?
3/ Is the Safety Thermostat set high enough? – for diagnostics, should be fully clockwise with the OTP light never on.
4/ Has the fuse/circuit breaker blown?

Indicated chamber temperature unstable	1/ ±0.1 may be normal. 2/ Is fan working? –verify movement of air in chamber. 3/ Is ambient room temperature radically changing – either door opening or room airflow from heaters or air conditioning ? – stabilize ambient conditions. 4/ This may happen if exhaust stack is 100% open or if power exhaust is cycling – adjust stack to at least ¼ closed. 5/ Sensor miss-located, damaged or wires may be damaged - check mounts for control and OTP sensors, then trace wires or tubing between sensors and controls. 6/ Calibration sensitivity – call Customer Service. 7/ High limit set too low – check if OTP light is on continuously; turn controller knob completely clockwise to see if problem solved then follow instructions in section 6.4 for correct setting. 8/ Electrical noise – remove nearby sources of RFI including motors, arcing relays or radio transmitters 9/ Bad connection on temperature sensor or faulty sensor – check connectors for continuity and mechanical soundness while watching display for erratic behavior; check sensor and wiring for mechanical damage. 10/ Bad connections or faulty solid state relay – check connectors for mechanical soundness and look for corrosion around terminals or signs of arcing or other visible deterioration. 11/ If set point is below 60 degrees, temperature can be unstable. See unit specifications for individual ranges.
Display and reference thermometer don't match	1/ Calibration error – See Controller Manual 2/ Temperature sensor failure 3/ Controller failure 4/ Allow at least two hours to stabilize. 5/ Verify that reference thermometer is certified.
Can't adjust set points or calibration	1/ Turn entire unit off and on to reset.
Calibrated at one temperature, but not at another	This can be a normal condition when operating temperature varies widely. For maximum accuracy, calibration should be done at or as close to the set point temperature.

MECHANICAL

Motor doesn't move

1/ If shaft spins freely: check connections to motor and check voltage to motor.
2/ If shaft rubs or is frozen, relieve binding and retest.

Motor makes noise

1/ If noise is from the motor, tap the top of motor shaft with ball peen hammer.
2/ If the sound gets worse, tap the other end of the shaft – avoiding touching the blower wheel.
3/ If there is no change, call Customer Service.

Door not sealing

1/ Adjust hinge blocks or twist the door.
2/ Confirm unit has not been damaged / body out of square.
3/ Check physical condition of gasket for tears or punctures.

OTHER

Controller on at all times - "locked-up"	1/ Adjust set point to room temperature. If the unit is still heating, replace the solid state relay. 2/Turn unit off and on to reset.
Controller timer resets on its own	1/ Confirm that power from wall is consistent and within specifications.
Front panel displays are all off	1/ Check connections to the temperature display control board and assure that all are tight and in the correct orientation. 2/ Check for wire damage.
Unit or wall fuse/circuit breaker is blown	1/ Check wall power source. 2/ Compare current draw and compare to specs on data plate. 3/ See what other loads are on the wall circuit.
Unit will not turn on	1/ Check wall power source. 2/ Check fuse/circuit breaker on unit or in wall. 3/ See if unit is on, e.g., fan or heater, and just controller is off. 4/ Check all wiring connections, especially around the on/off switch.
Unit is smoking – Out of box	This is not an uncommon occurrence when first operating new units. Put unit under vent and run at high temperature for one hour until smoke dissipates. See Section 3.6 “Burn-In”
Contamination in chamber	1/ See cleaning procedure in Section 7.1. 2/ Develop and follow standard operating procedure for specific application; include definition of cleaning technique and maintenance schedule.
Contamination in sample	1/ See “Contamination in chamber” above. 2/ Reduce air flow in chamber by dampening down exhaust port; be sure to verify adequate temperature uniformity at the reduced air flow. 3/ Protect open samples from areas of maximum air current, e.g., inlet air ducts.

8.1 Watlow Controller Settings: Refer to Section 1-2 of Watlow Manual

These are internal controller default settings pre-set at the factory for optimum oven performance. Altering these settings can cause performance problems. Please contact Customer Service if settings have been altered.

	MODE	SET TO	ALTERNATE
DISPLAY	**LOWER**	**UPPER**	**UPPER**
	SET	gLbL	
	C_F	C	F
	Err	Nla	Nla
	eI1	NO	NO
	ANUN	ON	ON
	LOP	0	0
	HIP	100	100
	ATSP	90	90
	PTYP	TI	Ti
	GSD	0	0
	POUT	CONT	CONT
	PSTR	STPT	STPT
	LOC	0	0
INPUT			
	IN1	J	J
	RL1	0	32
	RH1	300	572
	CAL1	0	0
	FTLR	0	0
OUTPUT			
	OT1	HT	HT
	HYS1	2	2
	OT3	ENT3	ENT3

Note: The PID Settings for the TFO Ovens are set by running the auto-tune feature at 150C.

Section 9

PARTS LIST

Please note – Part Numbers are subject to change.
Please confirm description and model number with your order.

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
TFO-1		**TFO-3**	
1800516	Power Cord	1800516	Power Cord
9570762	Element Assy.	9570537	Element Assy.
9600565	Blower Motor Assy.	9600565	Blower Motor Assy.
100056	Blower Wheel 6 x 2	100056	Blower Wheel 6 x 2
4880512	Blower Motor	4880512	Blower Motor
600002	Gasket 10 ft	600002	Gasket 10 ft
5120689	Shelf	5120690	Shelf
200129	Adjustable Feet	200129	Adjustable Feet
TFO-5		**TFO-10**	
101990	Power Cord	9570679	Element Assy.
9570665	Element Assy.	9600562	Motor Assy.
890081	Heating Element	100056	Motor Wheel 6 x 2
9600565	Blower Motor Assy.	4880512	Motor
100056	Blower Wheel 6 x 2	9600530	Cooling Motor Assy.
4880512	Blower Motor	210001	Cooling Motor
600002	Gasket 12 ft	891075	Cooling Fan 5.5
5120691	Shelf	600002	Gasket 12 ft
200129	Adjustable Feet	5120888	Shelf
		2700500	Adjustable Feet
TFO-28		**PARTS FOR ALL FORCED AIR OVENS**	
9570666	Element Assy.		
9600550	Motor Assy.	1750571	Thermostat 6’ Probe
100056	Motor Wheel	102162	Solid State Relay
4880512	Motor	9650503	Solid State Relay Assy.
9600551	Cooling Assy.	101827	TC Probe Closed End
891075	Cooling Fan 5.5	200020	Red Pilot Light
210001	Motor	103351	Green I/O Switch
600002	Gasket 17 ft	4450506	Soft Touch Knob
5120894	Shelf	200116	Shelf Clips - Small
2700500	Adjustable Feet	800542	Terminal Block 18
		101097	Power Exhaust 110V
		101098	Power Exhaust 220V
		1750540	Watlow 981 Controller
		200137	Shelf Clips - Large

Section 10

LIMITED WARRANY

Manufacturer warrants for the original user of this product in the U.S.A. only that this product will be free from defects in material and workmanship for a period of one year from the date of delivery to the original user. (the "Warranty Period").

During the Warranty Period, the Manufacturer, at its election and expense, will repair or replace the product or parts that are proven to Manufacturer's satisfaction to be defective, or at Manufacturer's option, refund the price or credit (against the price of future purchases of the product) the price of any products that are proven to Manufacturer's satisfaction to be defective.

This warranty does not include any labor charges if outside of the U.S.A. This warranty does not cover any damage due to accident, misuse, negligence, or abnormal use.

Use of Manufacturer's product in a system that includes components not manufactured by Manufacturer is not covered by this warranty.

This warranty is void in the event that repairs are made by anyone other than Manufacturer without prior authorization from Manufacturer.

Any alteration or removal of the serial number on Manufacturer's products will void this warranty. **Under no circumstances will Manufacturer be liable for indirect, incidental, consequential, or special damages.**

The terms of this warranty are governed by the laws of the state of Oregon without regards to the principles of conflicts of laws thereof. If any provision of this limited warranty is held to be unenforceable by any court of competent jurisdiction, the remainder of this limited warranty will remain in full force and effect.

This warranty is in lieu of and excludes all other warranties or obligations, either express or implied. Manufacturer expressly disclaims all implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose.

Section 11
OPTIONAL EQUIPMENT

11.1 COBEX CHART RECORDER INSTALLATION: TFO-10 & TFO-28

The following installation procedure is for installing a 6" Cobex Chart Recorder in a Cascade TEK TFO-10 or TFO-28 Forced Air Oven:

Uncrate oven. Do not connect power. Locate Chart recorder cut-out at the right corner of the instrument panel. Remove cut out cover. Remove the top of the oven to gain access to the electrical compartment.

Insure the chart recorder body has the "L" shaped mounting brackets. Insert the chart recorder into the recorder opening.

Using the "L" shaped brackets located on the top and sides of the recorder body, adjust and tighten the brackets against the inside wall of the instrument panel.

Locate the temperature probe hole in the top of the oven. Located right behind the back of the recorder allowing access to the oven work space.

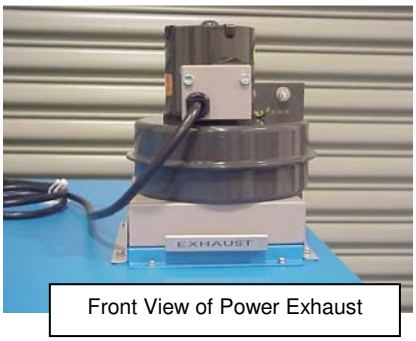
Feed the temperature probe into the oven workspace. Attach the probe to the bracket on the right side wall of the oven.
Note: The bracket will have the temperature probe from the oven controller already in place.

Located the Red and Black wires coming from the oven wiring harness and labeled "RECORDER". From the recorder, attach the black and white power wires to those leads with a wire cap. Attached the green or ground wire to any oven body screw that will provide good metal to metal contact.

Refer to the Chart Recorder Manual for operation and calibration.

11.2 POWER EXHAUST: TFO-10 & TFO-28

Description:



Front View of Power Exhaust

The power exhaust provides rapid evacuation (return to ambient) of the oven.

The power exhaust mounts to the top of the exhaust vent on the top of the oven.

The power exhaust plugs into the switched 220V outlet on the back top of the oven.

Operation of Power Exhaust

Rear View of Power Exhaust

Refer to Watlow 981 Controller Manual regarding “Event Outputs”.

“Event 3” in the Watlow 981 will control the on and off functions of the power exhaust within your program. If another event number is to be used, it will be labeled near the controller.

Press “Mode” button until “Event 3” displays.

Press the “UP” arrow to turn ON the Power Exhaust within in your profile.

Press the “DOWN” arrow within the profile to turn the power exhaust off.

11.3 GN2 PURGE OPERATION

Description:

The GN2 purge allows for an inert atmosphere within the oven's interior. Generally, the purge cycle should force a volume of gas equal to 5 to 10 times the volume of the oven.

The atmosphere within the oven is a mixture of room air and the purging gas until the purge cycle is completed. For this reason, the purge cycle should be finished before heat is applied to the chamber. Failure to properly complete a purge cycle may result in oxidation. A slight positive pressure should be maintained while running up to the set point temperature and throughout the heating portion of operation.

Gas atmosphere should be maintained until the work load is below the temperature at which oxidation will occur. Oxidation is generally detectable by a discoloration seen in the product. 125C is considered the highest / safe temperature. Most materials can be removed from the oven at this temperature without discoloration.

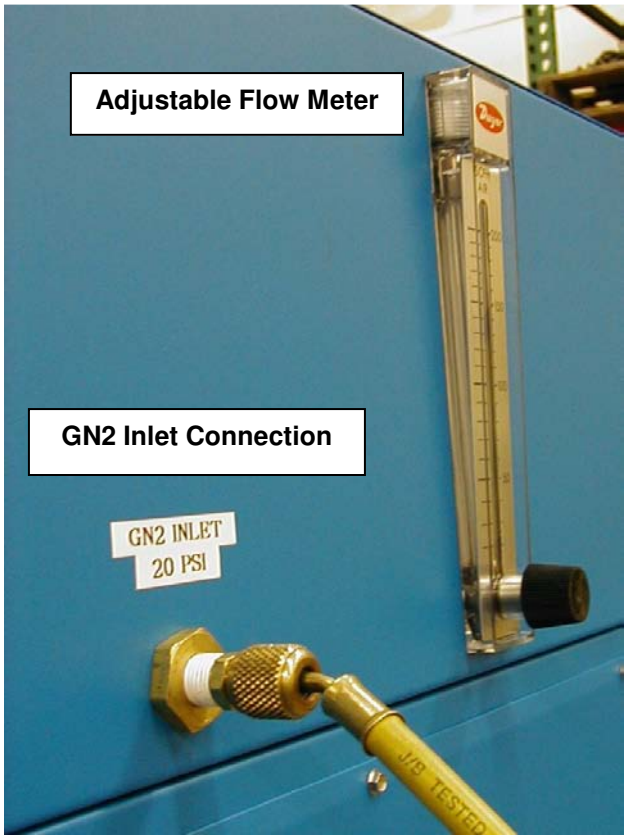
Requires a customer supplied GN2 Source. The GN2 purge system includes a flow meter, solenoid valve and event switch for operation via the Watlow 981 Controller.

Operation of GN2 Purge

See Watlow Manual for programming details regarding "Event Outputs".

"Event 3" = Turns ON the GN2 Purge Feature. If another event number is to be used, it will be labeled near the controller.

Press "Mode" button until "Event 3" displays. Press the "UP" arrow to turn on the GN2 Purge Flow Meter in your profile. Press the "DOWN" arrow to turn off.



Section 12
UNIT SPECIFICATIONS

Please refer to the unit data plate for its individual specifications.

TFO-1,	**1.6-cu/ft forced air oven**
Interior Dimensions:	13" W x 14 ¾" H x 14¼" D
Exterior Dimensions:	22 ½" W x 32" H x 21" D
Temperature Range:	5º C above ambient to 300ºC
Temperature Uniformity:	± 3℃ @ 150℃
Controls:	Watlow model 981 programmable microprocessor with ramp & soak capabilities. Independent over temperature controller.
Heaters:	1200 watts
Power:	120V, 1ph, 50/60Hz, 15A
Shelves:	2
Weight (uncrated):	127 lbs.

TFO-3	**3.2-cu/ft forced air oven**
Interior Dimensions:	18" W x 16 ½ " H x 19" D
Exterior Dimension:	28" W x 35 ¼ " H x 26 " D
Temperature Range:	5º C above ambient to 300ºC
Temperature Uniformity:	± 3℃ @ 150℃
Controls:	Watlow model 981 programmable microprocessor with ramp & soak capabilities. Independent over temp controller.
Heaters:	1600 watts
Power:	120V, 1ph, 50/60Hz
Shelves:	2
Weight (uncrated):	171 lbs.

TFO-5	**4.9-cu/ft forced air oven**
Interior Dimensions:	23" W x 18 ½ " H x 20" D
Exterior Dimension:	33" W x 37 ¼ " H x 27" D
Temperature Range:	5º C above ambient to 300ºC
Time to 150C:	Approx 20 mins
Temperature Uniformity:	± 2℃ @ 150℃
Controls:	Watlow Model 981 programmable microprocessor with ramp & soak capabilities. Independent over temperature controller.
Heaters:	2000 watts
Power:	230V, 1ph, 50/60Hz / 9amp
Shelves:	2
Access Port:	2" in rear
Weight (uncrated):	210 lbs.

TFO-10	**10.4-cu/ft forced air oven**
Interior Dimensions:	30”W x 30” H x 20”D
Exterior Dimension:	44”W x 77½”H x 29 ¾” D
Temperature Range:	5º C above ambient to 300ºC
Temperature Uniformity:	± 2℃ @ 150℃
Controls:	Watlow Model 981 Programmable Microprocessor with ramp & soak capabilities. Independent over temperature controller.
Heaters:	5,300 watts
Power:	230V, 1ph, 50/60Hz, 23A
Shelves:	3 adjustable
Port:	2½-access port
Vent:	1 air intake vent and 1exhaust vent
Weight (uncrated):	382 lbs

TFO-28	**28.0-cu/ft forced air oven**
Interior Dimensions:	31 ¼” W x 61” H x 25” D
Exterior Dimension:	42 ½” W x 86 ¼” H x 34 ¾” D
Temperature Range:	5º C above ambient to 300ºC
Temperature Uniformity:	± 2℃ @ 150℃
Controls:	Watlow model 981 programmable microprocessor with ramp & soak capabilities. Independent over temperature controller.
Heaters:	10,300 watts
Power:	230V, 1ph, 50/60Hz, 44A
Shelves:	6
Port:	2½ - access port in back
Vent:	1 air intake vent and 1 exhaust vent on top
Weight (uncrated):	455 lbs.

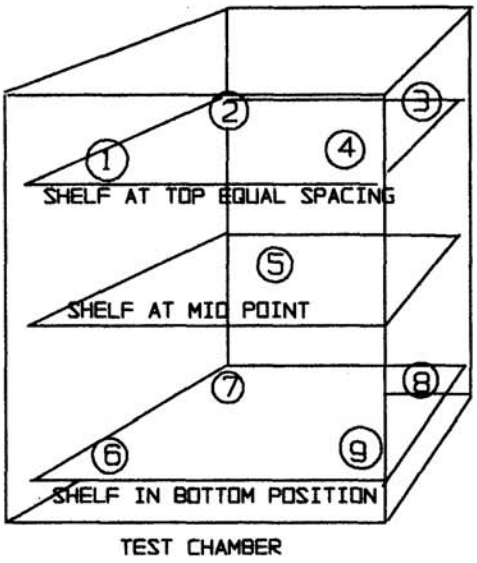
ASTM E 145-68 & ASTM 1292-94

TEST PROCEDURE | DESIGN ☐ | PROCEDURE NO. 9920527

PRODUCT INTEG. ☐ | VDE/BSI UL/CSA ☐ | OTHER ☒ | PAGE 1 OF 1

DESCRIPTION: PLACEMENT OF THERMOCOUPLES IN OVENS AND INCUBATORS FOR PERFORMANCE TESTING. TEST IS BASED ON ASTM E 145-68 AND ASTM 1292-94 BUT DOES NOT NECESSARILY COMPLY WITH ALL METHODS OR DETERMINATIONS.

THERMOCOUPLES: I/C TYPE J, 20 GA TEFLON/TEFLON - ALL WIRES TO BE FROM SAME ROLL AND WITHIN +/- 2" IN LENGTH OF ONEANOTHER.



MODEL WITH (3) SHELVES SHOWN

OTHER MODELS MAY HAVE MORE OR LESS SHELVES.

10

A. PLACE ONE SHELF IN THE LOWEST USABLE POSITION (AS RELATING TO SHELF SUPPORTS) SPACE THE REMAINING SHELVES EVENLY APART IN AN UPWARDS DIRECTION.

B. IF ACCESS OR EXHAUST/INLET PORTS ARE AVAILABLE, USE THESE OPENINGS TO RUN THE THERMOCOUPLES INTO THE CHAMBER. IF NO OPENINGS ARE AVAILABLE THE TERMOCOUPLES WILL HAVE TO BE RUN SO THE DOOR GASKET CLOSES ON THEM AND TRAPS THEM IN PLACE.

C. ROUTE THERMOCOUPLES (1,2,3,4, ETC.) AS SHOWN. THERMOCOUPLE 5 GOES IN THE APPROXIMATE GEOMETRIC CENTER OF THE CHAMBER. PROBES 1,2,3,AND 4 GO ON THE TOP SHELF AND PROBES 6,7,8, AND 9 GO ON THE BOTTOM SHELF.

D. PROBE 10 IS PLACED EXTERNALLY AWAY FROM THE UNIT TO MEASURE THE AMBIENT TEMPERATURE. (THIS PROBE CAN BE USED TO MEASURE OTHER FUNCTIONS)

E. FOR TEMPERATURES 100C AND LESS USE WIRE TIES OR STICK-ONS, FOR TEMPERATURES ABOVE 100C, WIRES WILL HAVE TO BE CAREFULLY WRAPPED THROUGH HOLES, SLOTS OR RUNGS AT THE PROPER LOCATION.

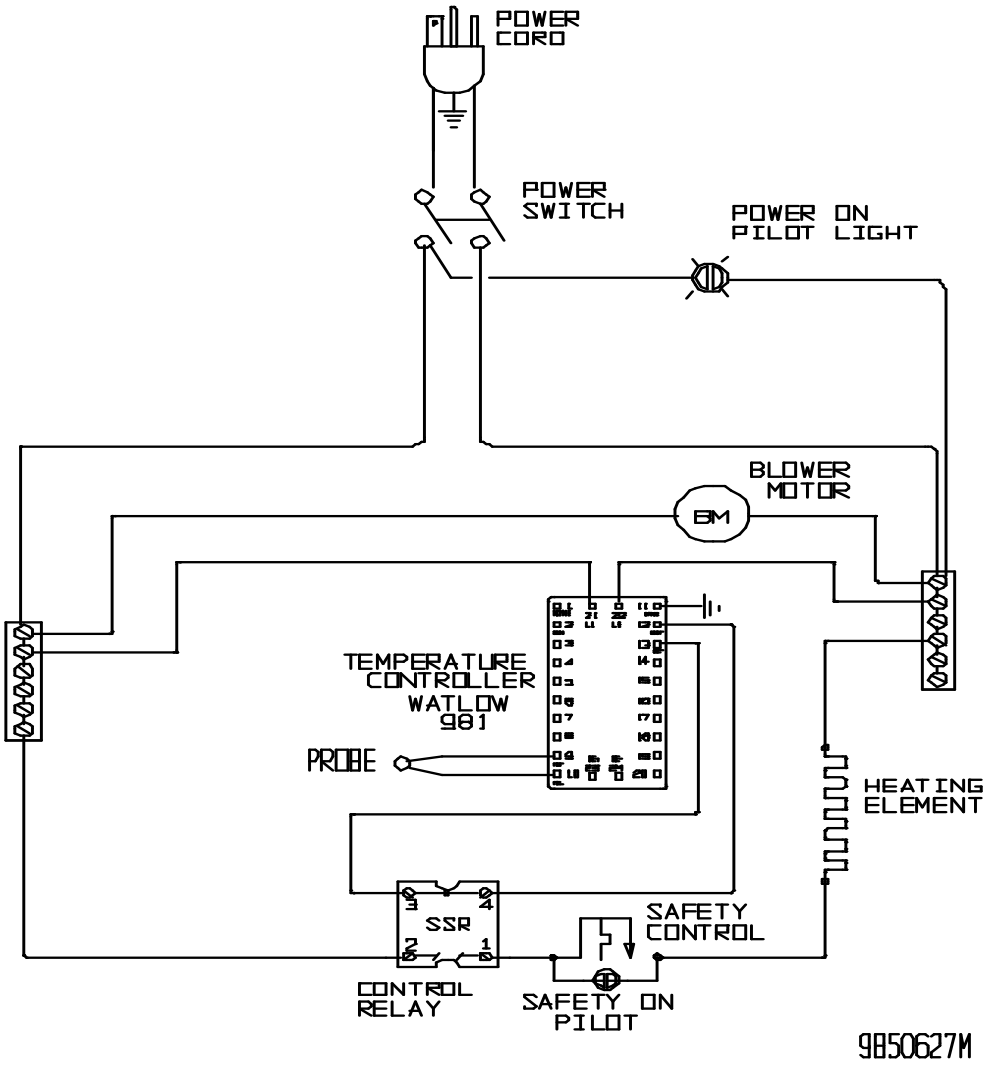
F. THERMOCOUPLES ON THE TOP AND BOTTOM SHELVES ARE PLACED 1" ABOVE THE SHELF AND 15% OF TH WIDTH FROM THE SIDE WALLS AND 15% OF THE DEPTH FROM THE REAR AND FRONT WALLS. VALUES ARE APPROXIMATE.

DOCUMENT 9920500

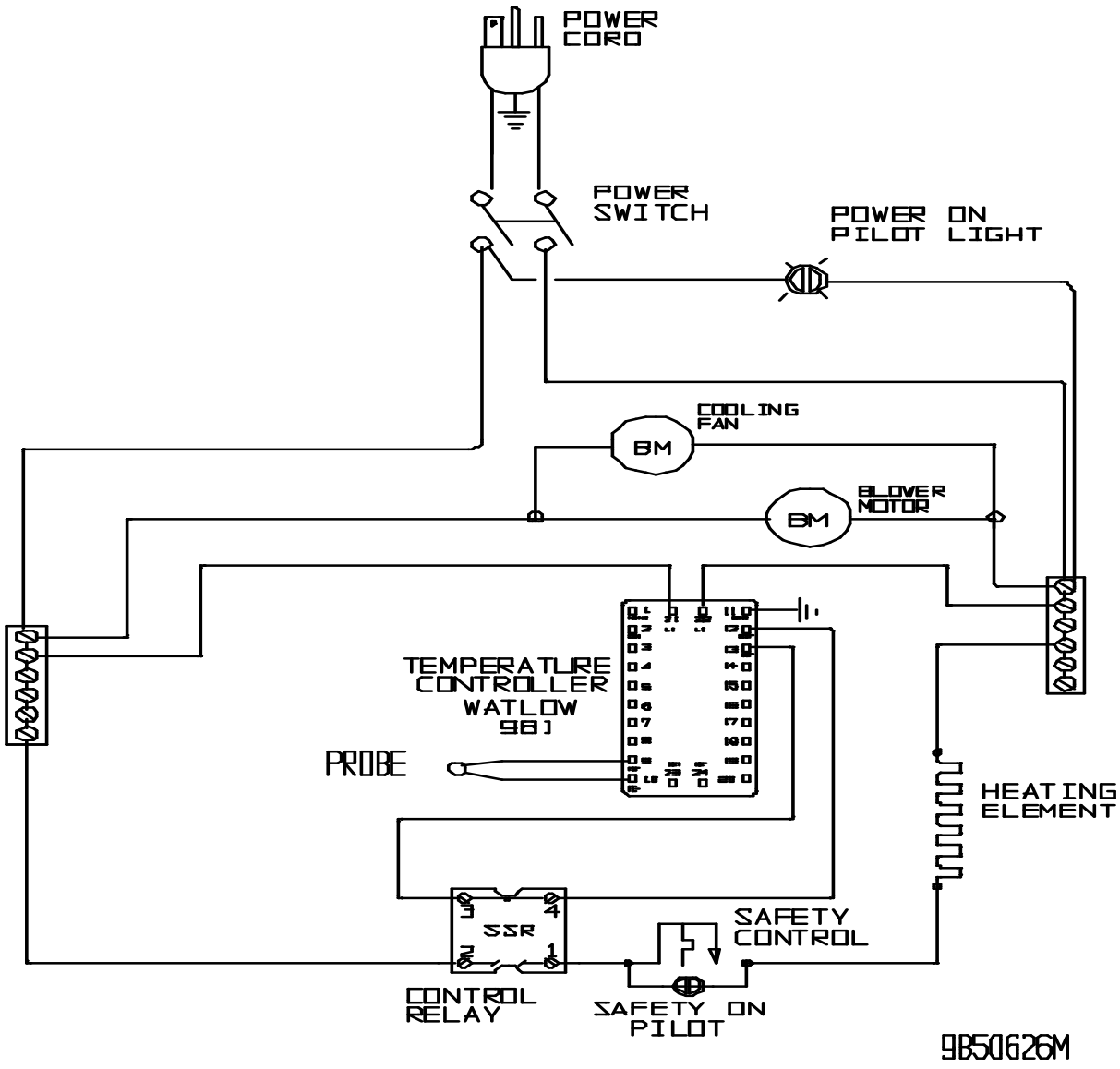
Section 13

SCHEMATICS

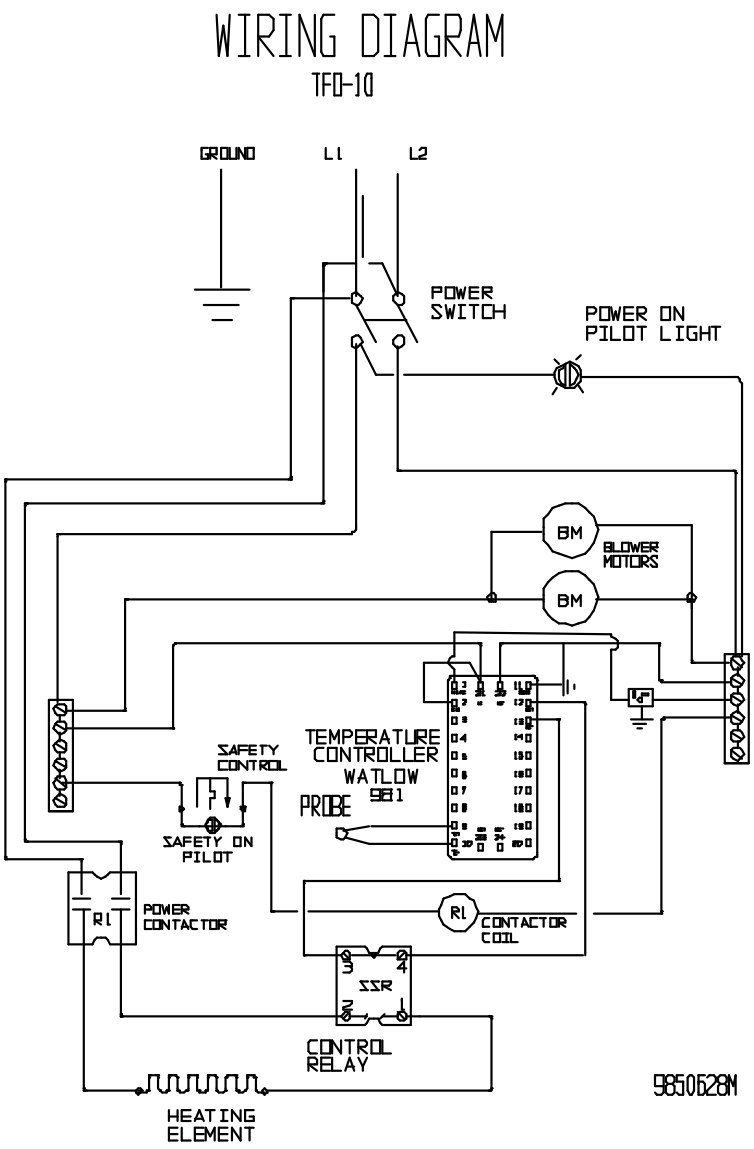
WIRE DIAGRAM : TFO-1 & TFO-3



WIRE DIAGRAM: TFO-5



WIRE DIAGRAM: TFO-10



WIRE DIAGRAM: TFO-28

WIRING DIAGRAM

TFO-28